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**Ion Transport and Local Structural Dynamics in Analogous Quaternary Ammonium and Phosphonium-Based Room Temperature Ionic Liquids** ADAM HOLT, University of Tennessee, Knoxville, PHILIP GRIFFIN, University of Pennsylvania, KATSUHIKO TSUNASHIMA, Wakayama National College of Technology, JOSHUA SANGORO, ALEXEI SOKOLOV, University of Tennessee, Knoxville — The ion transport and structural dynamics in a homologous pair of quaternary ammonium and phosphonium based room temperature ionic liquids (IL), [N2228][NTF2] and [P2228][NTF2], are investigated by depolarized dynamic light scattering and dielectric spectroscopy. The atomic identity of the cation center has a pronounced effect on both long-range ion conduction as well as structural relaxation in these quaternary ILs. The dc conductivity is significantly higher in the phosphonium based IL. While the increase in dc conductivity can be attributed to a lower glass transition temperature, i.e. faster structural dynamics, of the phosphonium IL, we also have found the atomic identity of the cation center strongly influences the local secondary relaxations. The secondary relaxations in the ammonium IL exhibit an unexpected non-Arrhenius temperature dependence—in stark contrast to its phosphonium counterpart. In addition to structural dynamics, changes in the secondary relaxations suggest the differences in dc conductivity may also be attributed to a change in counter-ion coordination and could lead to a difference in the mesoscale aggregation of alkyl moieties which is known to exist in these ILs. Therefore, subtle changes of inter-ionic interactions have a direct consequence on local, structural, and long-range dynamics in these analogous ILs.

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